526 Rec'd PCT/PTO 21 JUL 2000

FORM PTO-1390 REV. 5-93	US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEYS DOCKET NUMBER P00,1131
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/600698
INTERNATIONAL APPLICATION NO. PCT/EP98/08210	INTERNATIONAL FILING DATE 15 DECEMBER 1998	PRIORITY DATE CLAIMED 27 JANUARY 1998

TITLE OF INVENTION
"METHOD FOR OVERLOAD CONTROL FOR A SWITCHING CENTER"

APPLICANT(S) FOR DO/EO/US
GERTA KOESTER, ET AL.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2)) - drawings attached.
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2) - drawings attached.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 k U.S.C. §371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report)**.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. **(SEE ATTACHED ENVELOPE)**
13. ☒ Amendment "A" Prior to Action.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
    a. ☒ Submission of Informal Drawings, 4 sheets of drawings, Figures 1-4; and Request for Approval of Drawing Additions, 4 sheets of drawings, Figures 1-4.
    b. ☒ EXPRESS MAIL #EL 544622815US dated July 21, 2000.

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U.S. APPLICATION NO (if known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/600698	PCT/EP98/08210	P00,1131

17. ☒ The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO $840.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) .. $670.00		
No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) $760.00		
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $970.00		
International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 96.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 840.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).	$	

Claims	Number Filed		Number Extra	Rate		
Total Claims	11	- 20 =	0	X $ 18.00	$	
Independent Claims	01	- 3 =	0	X $ 78.00	$	
Multiple Dependent Claims				$260.00 +	$	
				TOTAL OF ABOVE CALCULATIONS =	$ 840.00	
Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$	
				SUBTOTAL =	$ 840.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+	$	
				TOTAL NATIONAL FEE =	$ 840.00	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property				+		
				TOTAL FEES ENCLOSED =	$ 840.00	
				Amount to be refunded	$	
				charged	$	

a. ☒ A check in the amount of $ 840.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 08-2290. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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Steven H. Noll
SIGNATURE

Steven H. Noll
NAME

28,982
Registration Number

BOX PCT
IN THE UNITED STATES DESIGNATED/ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY--CHAPTER II

APPLICANT(S): Gerta Koester, et al.

ATTORNEY DOCKET NO.: P00,1131

INTERNATIONAL APPLICATION NO: PCT/EP98/08210

INTERNATIONAL FILING DATE: 15 December 1998

INVENTION: "METHOD FOR OVERLOAD CONTROL FOR A SWITCHING CENTER"

Assistant Commissioner for Patents,
Washington D.C. 20231

AMENDMENT "A" PRIOR TO ACTION

Sir:

Applicants herewith amend the above-referenced PCT application, and request entry of the Amendment prior to examination on the United States Examination Phase.

IN THE SPECIFICATION:

On page 1:

cancel line 1 and substitute the following

--SPECIFICATION

TITLE

"METHOD FOR OVERLOAD CONTROL FOR A SWITCHING CENTER"

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates to a method for overload protection for an exchange, where neighboring exchanges are sent an overload congestion measure recognized network-wide.

Description of the Related Art--; therefor;

in line 6, cancel "in future by" and substitute --by developing-- therefor;

in line 9, cancel "slumps" and substitute --decreases-- therefor, and cancel ". There is" and substitute --, and there is a-- therefor;

in line 14, cancel ". The basic" and substitute --in which the basic-- therefor;

in line 15, cancel "already; that is, not even to let it approach" and substitute --before it arrives at-- therefor;

in line 22, cancel ".", and substitute --,-- therefor;

in line 23, cancel "stands for" and substitute --signifies-- therefor;

in line 24, cancel ". It" and substitute --and--;

in line 27, cancel "currently of" and substitute --e.g.,--;

in line 28, after "i.e.", insert --,--, and after "ACL", insert --has--; and

in line 29, cancel "[sic]".

On page 2:

in line 1, after "value", insert --,--;

in line 9, cancel ". Congestion" and substitute --in which congestion--, and after "refers to", insert --coordination processor--;

in line 16, cancel "LTGs" and substitute --line trunk groups (LTGs)-- therefor;

in line 21, after "i.e.", insert --,--;

in line 22, before "normal", insert --a--; and

in line 23, cancel "VT" and substitute --VST-- therefor.

On page 3:

in line 13, cancel "[sic]", and cancel "GP" and substitute --group processor (GP)-- therefor;

in line 14, cancel "there";

in line 15, after "routing", insert --,--; and

in line 18, cancel "[sic]".

On page 4:

in line 3, cancel "All lead it" and substitute --All of these lead-- therefor;

in line 4, cancel "run to and over" and substitute --exceed-- therefor;

in line 5, cancel "slumps" and substitute --declines-- therefor;

in line 9, cancel "drops" and substitute --declines-- therefor; and

in line 24, cancel ", with ACL2" and substitute --with ACL2,-- therefor.

On page 5:

in line 15, cancel "problemse [sic]" and substitute --problem-- therefor;

above line 19, insert

--SUMMARY OF THE INVENTION--;

cancel line 20 and substitute

-- This object is achieved by a method for overload protection for an exchange, comprising the steps of informing neighboring exchanges of the exchange which detects an overload of itself of a level of overload congestion via an overload congestion value that is specified network-wide, computing, in one of the neighboring exchanges, an effective congestion value from information of several of the overload congestion values, and controlling protective measures of the one of the neighboring exchanges with respect to a congested exchange. --

therefor; and

in line 23, cancel "VST. [sic]" and substitute --VSTs.-- therefor.

On page 6:

above line 1, insert

--BRIEF DESCRIPTION OF THE DRAWINGS --;

in line 2, cancel "shows" and substitute --is a block diagram showing-- therefor;

in line 3, cancel "shows" and substitute --is a block diagram showing-- therefor;

in line 5, cancel "shows" and substitute --is a block diagram showing-- therefor;

in line 7, cancel "shows" and substitute --is a block diagram showing-- therefor;

above line 9, insert

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--;

in line 11, cancel ", which" and substitute --. The OCL-- therefor;

in line 12, cancel "this comprises" and substitute --this value uses", and cancel "the values of the past" and substitute --past values-- therefor;

cancel line 16 and substitute --are damped) resulting in less extreme fluctuations-- therefor;

in line 21, after "without", insert --requiring--; and

in line 27, before "REL", insert --order: release--, and after "without", insert --an--.

On page 7:

in line 2, cancel "conformal" and substitute --conforming-- therefor.

On page 8:

in line 2, cancel "whereby" and substitute --but for selected weightings--; and

in line 4, cancel "recusively [sic]" and substitute --recursively-- therefor.

On page 9:

in line 2, cancel "henceforth" and substitute --below--;

in line 20, cancel "optical" and substitute --optimal-- therefor; and

in line 23, cancel "[...]" and substitute --in the-- therefor.

On page 10:

below line 29, insert

-- The above-described method is illustrative of the principles of the present invention. Numerous modifications and adaptions thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.--.

On page 11:

delete lines 1-12.

IN THE CLAIMS:

On amended page 12:

in line 1, replace "Patent Claims" with --WHAT IS CLAIMED IS:--

Please amend claims 1-11 as follows:

1. (Amended) A method [Method] for overload protection for an exchange, comprising the steps of: [according to which the]

informing neighboring exchanges of said [an] exchange which detects an overload of itself [are informed] of a [the] level of [the] overload congestion via an overload [a] congestion value that is specified network-wide; [.] [characterized in that]

computing, in one of said [a] neighboring exchanges [exchange], an effective congestion value [is computed] from [the] information of several of said overload congestion values, and;

[is used for] controlling [the] protective measures of said one of said neighboring exchanges [this neighboring exchange] with respect to a [the] congested exchange.

2. (Amended) A method [Method] as claimed in claim 1, further comprising the steps of:

[characterized in that]

transferring said [the] overload congestion value [is respectively transferred] in a call processing message; [,]

interpreting missing congestion information as an overload congestion value of 0 [whereby,] when a call processing message arrives without an overload congestion value, [the missing congestion information is interpreted as congestion value 0] and integrating said overload congestion value of 0 [is integrated] into said [the] computation of said [the] effective congestion value.

3. (Amended) A method [Method] as claimed in claim 1 [or 2], wherein said step of computing an effective congestion value further comprises the steps of:

[characterized in that]

forming an average value [said effective overload congestion value is computed in that], upon expiration of a definite time interval, [an average value is formed with the aid of] utilizing congestion values received during said definite [the] time interval; [,] and

utilizing said [this] average value [is utilized] to calculate said [the] current effective congestion value.

4. (Amended) A method [Method] as claimed in claim 1 [or 2], wherein said step of computing an effective congestion value further comprises the steps of:

[characterized in that]

computing [said current effective congestion value is computed in that], upon expiration of a time interval, a current effective congestion value [is computed] with the aid of:

an [the] average value of [the] overload congestion values received within said [the] time interval, and

an [of the] effective congestion value that was computed at an [the] end of an immediately [the] preceding time interval.

5. (Amended) A method [Method] as claimed in claim 1 [or 2], wherein said step of computing an effective congestion value further comprises the steps of: [characterized in that]

forming [the effective congestion value is calculated in that] time-interval-related average values [[A(j)] are formed] from [the] overload congestion values that are received in consecutive time intervals; [,]

weighting said [these] average values [are then weighted [w[j] · A(j)]]; and [,]

adding said [and lastly the] weighted average values [are added] over a time frame [[w[j] ·A(j)]], producing a summed weighted average.

6. (Amended) A method [Method] as claimed in claim 1 [or 2], wherein said step of computing an effective congestion value further comprises the steps of: [characterized in that]

[said effective congestion value is computed from the] utilizing a last effective congestion value and an [the] average value of [the] congestion values received within an immediately preceding [the last] time interval;

forming [in that, when said average value is greater than a specific first threshold value,] an effective congestion value [is formed] which is elevated by a specific first value relative to said [the] last effective congestion value when said average value is greater than a specific first threshold value; [,] and [,]

forming [when said average value is less than a specific second threshold value,] an effective congestion value [is formed] which is reduced by a specific second value relative to said last effective congestion value when said average value is less than a specific second threshold value.

7. (Amended) A method [Method] as claimed in claim 1 [or 2], further comprising the step of:

[characterized in that]

updating, [said effective congestion value is respectively updated] upon reception of a new overload congestion value, said [the] current effective congestion value being computed utilizing a [with the aid of the] previous effective congestion value and said [the] received congestion value.

8. (Amended) A method [Method] as claimed in claim 1 [one of the claims 1 to 7], wherein

[characterized in that]

said step of computing an effective congestion value comprises an effective congestion value [is] only [computed] when congestion has been established, said congestion being established [; that is,] when at least one positive congestion value has been received within a definite past time frame.

9. (Amended) A method [Method] as claimed in claim 1 [one of the claims 1 to 8], wherein

[characterized in that]

said congestion value is related to [a matter of] an ACL value in accordance with an ACC standard.

10. (Amended) A method [Method] as claimed [as claimed **[sic]**] in claim 1, wherein [one of the claims 1 to 9],

[characterized in that]

said protective measure [of a neighboring exchange is a matter of] comprises a measure selected from the group consisting of a denial of calls and [or] an alternate routing of calls.

11. (Amended) A method [Method] as claimed in claim 1 [one of the claims 1 to 10], further comprising the step of:

[characterized in that]

mapping said effective congestion value is mapped onto a protection control value, [in accordance with which] a neighboring exchange controlling a [controls the] protective measure implemented by said neighboring exchange utilizing said protection control value [it implements].

IN THE ABSTRACT

On page 15:

cancel line 2; and

cancel line 12.

REMARKS

The present Amendment revises the specification and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. All of the changes are editorial and applicant believes no new matter is added thereby. The amendment of claims 1-11 is not intended to be a surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

Submitted by,

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Siemens
New Case No. P001131
GR 98 P 1074 US
Inventor: Koester
Translation/June 13, 2000/ 1245 / 3490 words

Method For Overload Protection For an Exchange

Automatic Congestion control (ACC) is a network-wide protection mechanism with which exchanges are protected from overload congestion. ACC is becoming increasingly important compared to other standardized approaches, since proprietary methods such as Siemens' delayed release are being restricted in future by standards. In addition, ACC is the only protection mechanism that is provided for broadband exchanges. But the effectiveness of ACC is insufficient, as has been shown by network simulations. The performance of an exchange slumps dramatically in an overload situation. There is great danger of buffer overruns.

The standard mechanism is described below.

Automatic Congestion Control Under the ITU Standard

Automatic Congestion Control is described in the ITU Standards E.412, E.542, Q.763 and Q.764. The basic idea is to choke off traffic in the direction of a congested exchange (VST) at the neighboring exchange already; that is, not even to let it approach the congested VST. This approach entails three fundamental problems, on whose solution the quality of the algorithm depends:

- the information of the neighboring nodes,
- the control of the reactions at the neighboring nodes,
- the feedback via the success of the measures.

ACC provides 2 values to described congestion:

- An Automatic Congestion Level (ACL) of I signifies congestion.
- An ACL of 2 stands for heavy congestion.

The ACL is determined at the congested VST. It is transferred to the neighboring exchanges with the #7 message (release) when a call is initiated between the relevant exchanges (Figure 1). If a VST receives a positive ACL from a neighboring VST, a timer, currently of 10s, is wound up with the intention of providing that potential protection measures are stopped (i.e. canceled) again if a new positive ACL not arrived after the timer runs out. **[sic]**

At the neighboring VSTn of the congested VST, depending on the ACL value a certain percentage of all calls are denied or routed on an alternative path. The decision about which measure to take is up to the operator. The only rule is that the percentage must be a multiple of 12.5% (1/8).

Automatic Congestion Control in the EWSD Implementation

The implementation of the ACC in the system EWSD is detailed below (see Figure 2).

The EWSD implementation follows the ACC standard. Congestion refers to CP congestion. At the congested VST, the degree of congestion is calculated with the aid of the STATOR algorithm, and the number and average processing time of all messages that have arrived at the CP, as well as the computing capacity, are taken into account. Potential congestion is converted into the overload priority level (OPL) with the congestion grades 0,1,2,3,4,5 and 6.

In the congested VST, the OPL is attached by the CP to commands with JC1=0 (job code 1) by the "piggy-back" method, respectively, and is thus routed to the LTGs. Commands with JC1=0 are SET-UP-COMPLETE (in the set-up of a call) and COME-AGAIN (request for more information). This method means that the OPL value on an LTG is only updated when a call is established via the LTG. In this way, there is a diffusion of the information, which has an adverse effect with respect to ACC. There are several exceptional rules in the method: At the beginning of an overload situation – i.e. when the STATOR first detects overload congestion following a phase with normal load – an OPL of 3 is sent to all LTGs simultaneously via the command ADJUST-OPL. If the VT input list (switching input list) at the CP is in danger of overrunning (more than 800 entries), then the OPL=6 is outputted with the command ADJUST-OPL.

At the LTG, the OPL is converted into an ACL in accordance with the following schema (the ACL value 0 stands for little or no congestion):

OPL	ACL
0	0
1	0
2	0
3	1
4	1
5	2
6	2

An LTG at the congested VST now sends an ACL to the neighbors with each message REL in accordance with Standard #7 (see Figure 3). There, the ACL is likewise received on an LTG. With the message REL-C (release complete), which informs the CP about the resolution **[sic]** of a call, the ACL is transported by the GP of the LTG to the CP of the neighboring VST and is entered into the trunk data base there in bundles. This means that denial, or respectively, alternate routing takes place at the neighboring VST in bundles. Furthermore, this means that it is possible for different – that is, conflicting – information to be received nearly simultaneously at the neighboring VST to a bundle in the direction of the congested VST. **[sic]** This information can stem from different LTGs of the congested VST, for example. Positive ACL values are thus immediately overwritten.

In the trunk data base of the CP, a timer of 10s is wound up with every arrival of a positive ACL. When this timer expires without a new positive ACL having been received, the ACL in the trunk data base is decremented by 1, and the timer is rewound (in case of a new ACL value of 1).

At the neighboring exchanges, the type and intensity of the reaction is fixed in tables that are set up manually. The denial occurs globally as provided in the standard. Thus, for example, given an ACL of 1, 50% of all calls could be denied, and given an ACL of 2, 100%.

Three Main Problems of the ACC Algorithm

Primarily three weaknesses of the algorithm are responsible for the performance deficits in ACC that have been detected in simulations. All lead it to heavy, abrupt vacillations in offered traffic, as a consequence of which lists run to and over capacity, the queues grow long, and the throughput slumps.

Problem 1: Imprecise Control

The highly imprecise controlling of denial using only 2 ACL values and corresponding denial rates leads to heavy fluctuations in offered traffic, as a consequence of which the input lists at the CP grow very long, and the throughput drops.

Problem 2: "barn door effect"

When a VST overloads, it sends the same ACL to *all* neighboring VSTn (nearly) simultaneously. Thus, the same proportion of traffic at all neighboring VSTn across the board is choked off in the direction of the congested VST. Given an ACL of 1, i.e. "normal" congestion, this usually means that the congested VST is now offered less traffic than it can actually handle. It goes into *underload* , and the STATOR computes an OPL of 0. Despite this, the neighbors choke off the traffic for at least 10s longer, until the timer has expired at all neighbors, the ACLs in the trunk data base have been set back there, and the *full* volume of traffic has been permitted. The "barn door" is then reopened. The VST immediately detects congestion again, and the process is repeated.

The protection period can last longer than the 10s of the timer if ACLs which have not been updated for a long time by a SET-UP-COMPLETE/COME-AGAIN command dwell at some LTGs of the congested VST. These incorrect ACLs are distributed to the neighbors via REL messages, where they overwrite zero values in the trunk data bases. Given heavy congestion, with ACL2 the effects of the timer are lost, since positive ACL values are immediately entered into the trunk data base. Yet the lingering non-updated ACLs produce a similarly unfavorable effect nevertheless.

The "barn door effect" thus likewise leads to heavy abrupt fluctuations of offered traffic. Long queues and wait times at the CP arise, and the throughput collapses.

Problem 3: Information deficits given high denial rates

The ACL is transferred in that it is attached to messages belonging to (SET-UP-COMPLETE, COME-AGAIN, REL, REL-C) calls. Thus, a certain proportion of calls must be successfully forwarded to the congested VST in order to guarantee the information exchange. But given high across-the -board denial rates (100%), situations arise in which almost no calls are routed to the congested VST. Too few SET-UP-COMPLETE commands leads to the OPL and ACL on the LTGs of the congested VST not being up to date. Too few REL messages results in obsolete ACLs on the neighboring exchanges. To prevent the endless persistence of overload values when the information exchange breaks down completely, the OPL on the LTGs of the congested VST is decremented every 4 seconds and is adapted to the ACL accordingly. This "emergency brake" can only ameliorate the problemse **[sic]**, however.

If an attempt is made to solve these problems by shortening the 10s timer of a neighboring VST, the same negative effects appear. In addition, given heavy congestion, the protection phase is too short, and so the overloaded lists can no longer be cleared.

The invention is based on the object of solving the above described problems. This object is achieved by a method as claimed in claim 1.

The invention improves protection control without an information exchange that has been established network-wide having to be modified or impaired between the VST. **[sic]**

The invention is detailed below with the aid of the drawing, which encompasses 4 Figures.

Figure 1 shows the ACC method under the ITU standard.

Figure 2 shows the determination of the degree of congestion (ACL value) in the congested VST.

Figure 3 shows the informing of a neighbor VST with the aid of delivered ACL values.

Figure 4 shows the evaluation of the ACL value information in the neighboring VST in bundles.

The inventive method computes what is known as an effective congestion value (OCL value) from the rough information (ACL values) received from a neighboring exchange, which value approximates the actual degree of congestion of a congested exchange, since this comprises a finer gradation, and the values of the past can be incorporated into its calculation. Unlike an actual momentary congestion grade, the calculated effective congestion value is smoothed in order to control the protection more softly (smoothing means that peaks in the characteristic curve of the actual congestion value are damped). The protection regimens thus fluctuate less extremely.

The simulations demonstrate very good performance data (calls put through, wait times, queue lengths, processor usage) at the congested exchanges particularly in conjunction with another denial method (denial at the congested exchange itself in accordance with the "overload priority level OPL"), which is used at Siemens exchanges. But the invention meaningfully relieves the exchanges without additional protection measures besides ACC.

Recovery of the actual level of congestion and smoothing

The following exemplifying embodiments are all based on the idea of recovering the actual level of congestion from the rough ACL values 1 and 2 and the indirect information from an REL message without ACL (meaning no congestion) and smoothing this in order to stabilize the protection measures. To this end, an effective degree of congestion, known as the OCL (overload congestion level), is determined from the history of the received ACLs, that is, from the information of several past ACLs, and

this is mapped onto a protection control value in accordance with which the neighboring exchanges protect in a finer gradation. The finer gradation can be laid out as conformal to the ITU standard (see exemplifying embodiments).

Exemplifying embodiments for calculating the smoothed overload congestion level OCL are given below.

Example 1: Calculation of the overload congestion level from all ACLs that are received within a ceratin time frame

Though an individual ACL value gives only very approximate information about the overload situation, one can obtain more precise statements, which are also smoothed, by considering the values which arrived previously and determining a reasonable average value. The following approach was tested in simulations and leads to significant improvements of the performance:

At an interval of one second, respectively, the average value over all ACLs that arrived in the preceding second interval is formed. REL messages that arrive without ACC information are assigned the pseudo-ACL-value 0. In this way, the negative information of an empty REL message is also used; that is, the information "there is no overload". A(j) characterizes the average value over the ACLs and pseudo-ACLs for the interval which began j seconds ago. The average values are weighted and added, and thus the new overload congestion level OCL is formed as a weighted average. The OCL is a compressed image of the OPL and can accept all values between 0 and 2.

$$OCL = \sum_{j=1,\ldots,n} w(j) \cdot A(j), \quad n = 20, \quad w(j) = \frac{1/\sqrt{j}}{\sum_{k=1}^{20} 1/\sqrt{k}}$$

Formula 1: OCL determination (each second) from the ACL average values of the last 20 one-second intervals.

Good results were obtained in simulations with the above described weights *w(j)*. Of course other weights are possible in principle, whereby it is important for the smoothing that the weights do not drop too rapidly as the index *j* rises.

As another possibility, the OCL can be determined semi-recusively **[sic]**. This presupposes an initialization of the OCL. The first ACL average value is used for this.

$$OCL_{new} = \alpha \cdot OCL_{old} + (1-\alpha) \cdot A(1)$$

Formula 2: semi-recursive OCL determination

Selecting $\alpha=1/2$, one obtains the terms of the geometric series as weights. With $\alpha=0.9$, one obtains a similarly good functioning of the method in simulations as when the sum formula in formula 1 is used. With the aid of simulations, the optimal value for α can be determined.

Protection occurs in accordance with the following schema:

Congestion Level	Protection in %
0.00-0.249	0
0.25-0.499	12.5
0.50-0.749	25
0.75-0.999	37.5
1.00-1.249	50
1.25-1.499	62.5
1.50-1.749	75
1.75-1.999	87.5
2.00	100

Table 2: Protection according to OCL values

According to table 2, each OCL is mapped into a value for controlling the protection level, which is referred to henceforth as a protection control value.

Example 2: calculation of a smoothed OCLs with the aid of the timer

Here, the 8 gradations of the OPL are provided for the OCL: 0, 1, 2, 3, 4, 5, 6, 7, 8. In addition there are two basic statuses of a (neighboring) VST with respect to congestion:

– "no congestion detected",

– "congestion detected".

When an ACL>0 is received for the first time following a phase of normal load, the basic status changes to congestion detected. The OCL is then initialized, for instance to the value 4. At the same time, a timer of 1 second is started. When the timer runs out, the average value A(1) over all ACLs in the preceding one-second interval is used to adjust the OCL:

$$\boxed{\begin{aligned} A(1) \geq \alpha &\Rightarrow OCL_{new} = \min\left(OCL_{old} + 1.8\right), \\ A(1) \leq \beta &\Rightarrow OCL_{new} = \max\left(OCL_{old} - 1.0\right). \end{aligned}}$$

Formula 3: OCL adjustment upon timer expiration

For α and ß the values α=1.5 and ß=0.5 are suggested. The optical parameters can be found via simulations. Past simulations have demonstrated that the method would have to be refined – perhaps by introducing additional threshold values – in order to achieve a performance capability comparable to the method described **[...]** previous section.

If the OCL remains at 0 in a 10-second interval (a second timer), and only ACL=0 is received, the VST reverts to the basic status "no congestion detected". Choke-off occurs as in the above proposal.

Congestion Level	Protection in %
0	0
1	12.5
2	25
3	37.5
4	50
5	62.5
6	75
7	87.5
8	100

Table 3: Protection according to OCL values

Calculation upon consideration of the frequency of incoming ACLs

Another possibility for recovering information is to integrate the frequency of incoming ACLs: The OCL is updated upon reception of each ACL. The OCL values 0,1,2,3,4,5,6,7,8 are again used, and protection follows table 3. The adjustment of the OCL is controlled as follows (initialization of the OCL_alt: OCL_alt=0).

OCL_alt	ACL=0	ACL=1	ACL=2
0,1,2	$OCL_{new}=max(OCL_{old}-1.0)$	$OCL_{new}=min(OCL_{old}+1.8)$	$OCL_{new}=min(OCL_{old}+2.8)$
3,4	$OCL_{new}=max(OCL_{old}-1.0)$	$OCL_{new}=min(OCL_{old}+1.8)$	$OCL_{new}=min(OCL_{old}+2.8)$
5,6	$OCL_{new}=max(OCL_{old}-1.0)$	$OCL_{new}=OCL_{old}$	$OCL_{new}=min(OCL_{old}+1.8)$
7,8	$OCL_{new}=max(OCL_{old}-2.0)$	$OCL_{new}=max(OCL_{old}-1.0)$	$OCL_{new}=min(OCL_{old}+1.8)$

Formula 4: Adjustment of the OPL with each incoming ACL (accounting for frequency)

Further smoothing could be achieved in that all ACLs coming in in a certain time interval after an adjustment of the OCL are ignored. However, such a smoothing concept would conflict with the desire to exploit incoming positive ACL values.

Abbreviations

ACC	automatic congestion control
ACL	automatic congestion level
CP	coordination processor
GP	group processor – processor on the LTG
LTP	line trunk group
OCL	overload congestion level
OPL	overload priority level
REL	order: release
REL-C	message: release complete
VST	exchange

Abstract

Method For Overload Protection For an Exchange

Automatic Congestion Control (ACC) is a network-wide method for overload protection for an overloaded exchange, according to which the neighboring exchanges of an overloaded exchange are informed by this exchange of the level of congestion via a congestion value (ACL value) that is specified network-wide. But ACC provides only two values for the ACL value and therefore leads to intensive, abrupt protection measures in said neighboring exchanges. The invention solves this problem in that an effective congestion value (OCL value) is computed in a neighboring exchange from the information of several ACL values and is used to control the protective measure of this neighboring exchange with respect to the congested exchange.

Figure 3

FIG 1

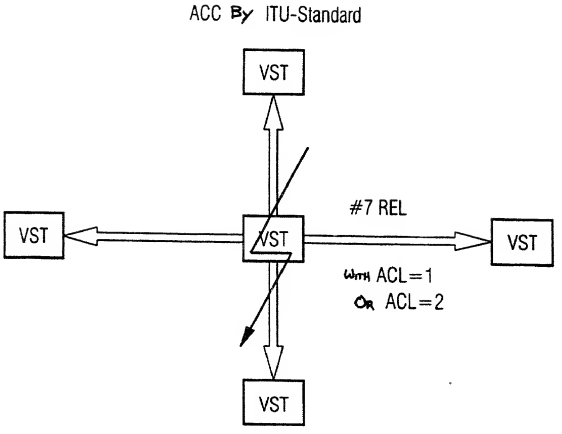


FIG 2

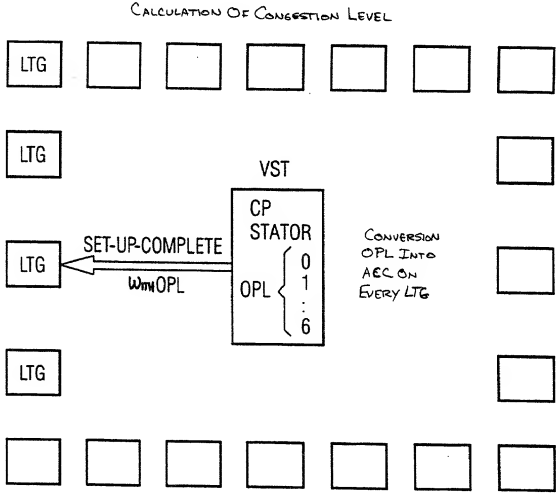


FIG 3

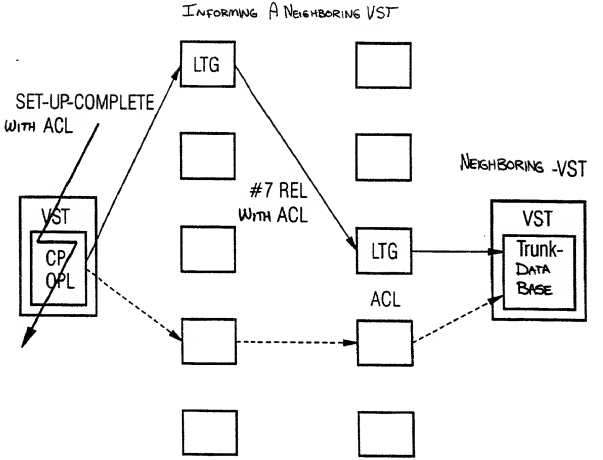
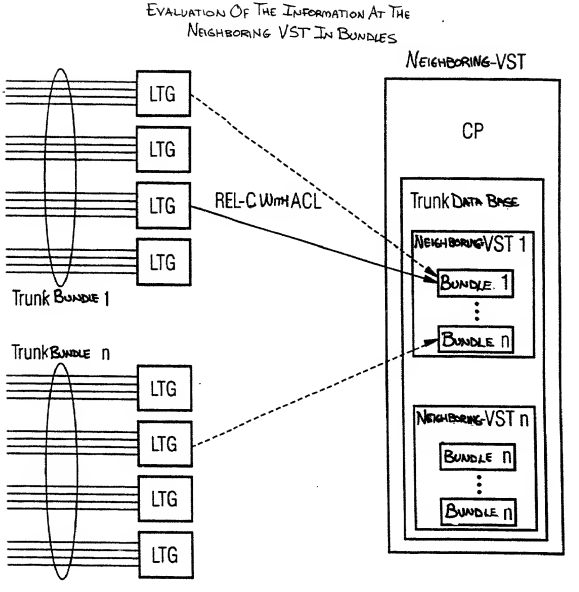


FIG 4


EVALUATION OF THE INFORMATION AT THE NEIGHBORING VST IN BUNDLES
NEIGHBORING-VST
CP
TRUNK DATA BASE
NEIGHBORING VST 1
BUNDLE 1
BUNDLE n
NEIGHBORING-VST n
BUNDLE n
BUNDLE n
LTG
LTG
LTG
LTG
REL-C WITH ACL
TRUNK BUNDLE 1
TRUNK BUNDLE n
LTG
LTG
LTG
LTG

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Verfahren zur Überlast-Abwehr für eine Vermittlungsstelle

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)
☒ hier beigefügt ist.
☐ am _____ als PCT internationale Anmeldung PCT Anmeldungsnummer _____ eingereicht wurde und am _____ abgeändert wurde (falls tatsächlich abgeändert).

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☐ is attached hereto.
☐ was filed on _____ as PCT international application PCT Application No. _____ and was amended on _____ (if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
98101399.8	Germany (EP)	27.Januar 1998	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

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(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date) (Anmeldedatum)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

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Unterschrift des Erfinders Datum	Inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

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(Supply similar information and signature for third and subsequent joint inventors).